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# Septic Arthritis and Osteomyelitis from a Cat Bite

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A 39-year-old man with no prior history of underlying arthritis developed osteomyelitis and septic arthritis in his hand following a cat bite. This case illustrates the virulence of *Pasteurella multocida* infections associated with animal bites, particularly those of cats, whose teeth can inoculate bone directly. The onset of cellulitis caused by *P. multocida* infections is often rapid, and the drug of choice for such infections remains penicillin. Appropriate antibiotic therapy, however, does not always prevent complications such as those seen in this patient.

## CASE PRESENTATION

DR. JEFF CHODAKEWITZ *(Infectious Disease Fellow):* Our patient is a 39-year-old man who had been well his entire life. He was first seen in the emergency room of the West Haven Veterans Administration Hospital in May of 1985 for a cat bite of his left hand and was treated with cephradine (Velosef). He did well for several days, but he returned to the emergency room five days later, complaining of increased swelling of his left hand. He was given a prescription for oral penicillin and sent home. He apparently did well at home, but with continued pain in his hand, so he returned to us in July of 1985 (two months after the initial evaluation) because of this persistent pain. At that time a radiograph of the painful hand was obtained, and it demonstrated soft-tissue swelling over the first and second metacarpal bones. Bone erosions were not visible. No fluid was evident in the joint space. He simply had some residual pain and minimal decrease in movement.

A PHYSICIAN: How long had it been since the cat bite?

DR. CHODAKEWITZ: About six or seven weeks by this time. He had received a long course of oral penicillin V potassium while at home, but he was not receiving any penicillin at the time of admission. Because of his persistent pain and equivocal radiographic findings, the first of two radionuclide scans was performed. The technetium 99-MDP bone scan was performed in July and a study done 4½ hours after injection shows some abnormal areas (Fig. 1). The second scan was performed using gallium-67 citrate; it shows increased uptake in both the second and third metacarpophalangeal (MCP) joints (Fig. 2).



*Abbreviations:* MBC: minimum bactericidal concentration MCP: metacarpophalangeal MIC: minimum inhibitory concentration

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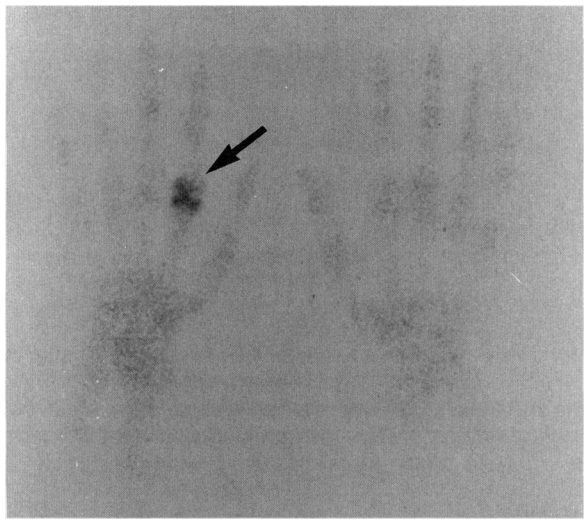

FIG. 1. Technetium bone scan, demonstrating asymmetric uptake of radionucleotide in the area of right second and third metacarpophalangeal joints.

DR. STEPHEN EDBERG *(Director, Microbiology Laboratory, Yale–New Haven Hospital):* If one investigates the mouth flora of dogs and cats, one finds some organisms that are not susceptible to the currently available penicillins and cephalosporins. I don't think you can choose one antibiotic that would cover all the possible bacterial agents in an attempt to prevent soft-tissue infection and osteomyelitis from a cat bite. This situation generally calls for a bone biopsy.

DR. THOMAS GRECO *(Chief, Infectious Diseases, St. Mary's Hospital):* We had a similar case of *Pasteurella multocida* osteomyelitis in Waterbury recently, and bone biopsy is the best way to make a diagnosis. *Pasteurella multocida* can cause a rapidly developing osteomyelitis. We have reported two cases of chronic Pasteurella osteomyelitis, and Dr. Edberg's point is well taken. This case is chronic and partially treated. You need more information.

DR. CHODAKEWITZ: This case was partially treated with penicillin which, I am sure, modified his clinical course. The surgeons did not feel an open biopsy procedure was indicated, but he did have a bone aspiration performed, and a culture of the aspirated

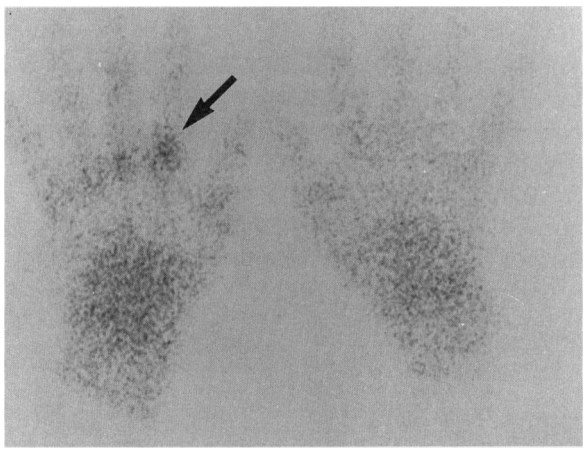

FIG. 2. The second and third metacarpophalangeal joints have enhanced gallium uptake, similar in intensity to that seen on the bone scan. This finding is consistent with an ongoing infectious process such as osteomyelitis and/or arthritis.

material grew *Pasteurella multocida.* Once again he received a course of oral penicillin while being followed with serial gallium scans for two months. There was no improvement, so he was readmitted to the hospital four months after the initial cat bite injury.

On admission, localized pain was present in the soft tissues overlying his first and second metacarpal bones. He had a white blood count of 10,000 cells/$\mu$l and a sedimentation rate of 17 mm/hr (nl <20). At operation, the surgeons found destruction of cartilage and chronic changes consistent with an ongoing inflammatory process in these joints. There was also destruction of the proximal portion of his second metacarpal bone. Hence, he had developed a partially treated osteomyelitis and a contiguous septic arthritis. The cultures obtained during this procedure were unrevealing. We were asked to see him at this point, because he had one colony of an unidentified streptococcus species growing, and the surgeons wanted to know how to treat him. *P. multocida* was not detected. What would you tell them?

A PHYSICIAN: When you are dealing with animal bites, there is almost no way to know whether such an isolate is merely a contaminant without more information. Agreed, this was one colony from multiple biopsy samples, but you cannot feel comfortable saying that it was only a contaminant. Was a gram stain performed on the biopsy material?

DR. CHODAKEWITZ: Yes, and it was negative. This finding favors the view that the single isolate was only a contaminant.

DR. FRANK BIA *(Associate Professor of Medicine):* The issues in this case are relevant to patients who are seen in the emergency room with cat or dog bites. It has been my impression that experienced medical house officers will offer prophylaxis for *Pasteurella multocida* infections by prescribing penicillin. Often enough, an inexperienced house officer sees the patient first, and he or she attempts to use oral cephalosporins. Do you know what the minimum inhibitory concentrations (MICs) are? My impression is that the cephalosporins are not drugs of choice for Pasteurella infections because the MICs are too high.

DR. CHODAKEWITZ: Weber reported both the MICs and minimum bactericidal concentrations (MBCs) for all their *Pasteurella multocida* isolates [1]. Although the organisms were sensitive to each tested antibiotic, the tissue levels of orally administered first-generation cephalosporins would not reach these MICs. You could have predicted the poor response to several cephalosporins which we now know are associated with treatment failures. The same is true for erythromycin. In addition, the ratios of MBCs to MICs for penicillins and first-generation cephalosporins were low, but for many of the other drugs, including chloramphenicol and tetracycline, the ratio was quite high. Antibiotics that are normally thought of as being effective against Pasteurella infections, based on MICs, can be associated with relatively high MBCs.

A PHYSICIAN: Since you are on the topic of antibiotic coverage, if one were in the emergency room, and a patient who was clearly penicillin-allergic came in with this problem, what would be the alternative antibiotic?

DR. CHODAKEWITZ: Tetracycline is the drug of choice for oral therapy if you cannot use a penicillin.

A PHYSICIAN: Do some of the newer oral antibiotics such as the fluoroquinolones have acceptable MICs against *P. multocida?* That would be an ideal situation, particularly

since these organisms have such a propensity for causing osteomyelitis if not quickly eliminated.

DR. CHODAKEWITZ: They do, at least *in vitro* [2]. Even patients who were initially placed on penicillin therapy, however, have developed well-documented Pasteurella infections and their complications. There is no guarantee that osteomyelitis would have been prevented had this patient been given penicillin initially. Even though the importance of *Pasteurella multocida* infections after a cat bite and the superiority of penicillin therapy are well understood, recommendations for initial therapy with a cephalosporin still occur.

A PHYSICIAN: There is some microbiological folklore among house officers about staphylococcal infections resulting from such bites. When I investigated, I found some reports which included *S. aureus*. Everybody mentions it, but I was struck by how rarely it is documented in this clinical situation.

DR. CHODAKEWITZ: Those series of reports examining the microbiology of animal bites do include some *S. aureus* infections, but *P. multocida* predominates, particularly in cat injuries. *S. aureus* is more commonly found in the flora of human bites. *P. multiocida* is not seen in that setting [3,4,5].

DR. BIA: Some investigators have written about the differences between various kinds of bites. Cats have long, sharp, teeth and a tendency to inoculate bone immediately. The resolving cellulitis one sees is not a true reflection of what is actually occurring. If it is not a cat scratch, or cat lick over a scratch, then there is a fairly good chance for cat teeth to have inoculated bone.

Cellulitis and tissue swelling occurring within 24 hours or less of such a bite are good indications one is dealing with *Pasteurella multocida*. That is what most clinicians emphasize, particularly the cellulitis component. I have also been struck by the variation in presentations. Although most patients develop symptoms within 48 hours, there were those who presented, like today's patient, weeks after the initial bite [1].

DR. GEORGE THORNTON *(Chief of Medicine, Waterbury Hospital):* A small point regarding diagnosis. In my limited series of perhaps four cases of Pasteurella soft-tissue infections, each of them has produced purulent material that could be gram-stained. It's an underutilized procedure in emergencies. You can often see the tiny gram-negative diplococci and make a presumptive diagnosis.

## DISCUSSION

DR. CHODAKEWITZ: This patient brings up several important issues. While most animal bites are clinically trivial, these injuries may result in serious sequelae if not treated properly. The microbiology of animal bites is complex, largely reflecting the microflora of each animal's oropharynx. We have referred to the frequency of *Pasteurella multocida* infections after cat bites. Cats show *P. multocida* in their oral flora in 70–90 percent of samples cultured [6]. In those series which report wound culture results based on the animal involved, *P. multocida* is the sole or primary pathogen in most cases [3–5]. Dogs show the organism in about 50 percent of cultures [7]. Wounds from dog bites are more likely to contain multiple organisms. It had been thought that dog bites were a rare cause of deep infection. In general that is true, although there are case reports of dog bites causing osteomyelitis [8]. The role of anaerobes in causing infectious complications of animal bites is unclear. Application of good anaerobic culturing techniques shows that as many as 40 percent of infected animal bites contain

anaerobes [9]. This result is not surprising in view of the recovery of these organisms from healthy animals. The success of therapy which includes little coverage for anaerobic organisms suggests that these organisms may not be primary pathogens in such infections.

Gram stains of purulent material may suggest the presence of *P. multocida.* The organism is a small gram-negative coccobacillus which frequently shows bipolar staining. The most common clinical syndrome associated with *P. multocida* is a soft-tissue infection following an animal bite. The rapid onset of an intense inflammatory response is characteristic [1,10].

Less frequently, *Pasteurella multocida* may be the etiologic agent in a range of clinical settings including pulmonary infection, bacteremia, intra-abdominal infections or, as in our patient, bone and joint infections [1,11–13]. Even for those infections unrelated to animal bites, many patients have a history of animal exposure [1]. Skeletal involvement is generally associated with bites.

A review of bone involvement by Pasteurella species is found in the article by Ewing et al. [8]. They divide the syndromes of skeletal infections into three types. Type one is isolated septic arthritis; type two is an isolated osteomyelitis, and the third type is really a combination of arthritis and osteomyelitis, as seen in our patient. Isolated septic arthritis generally involves those joints immediately proximal or distal to a bite. Such joints are often abnormal to begin with, and there is a clear predilection for prosthetic joints [8,14]. Fortunately, those patients seem to do well.

Osteomyelitis usually occurs because of direct inoculation, especially when due to cat bites. These patients also seem to do fairly well with aggressive therapy. Patients who have both arthritis and osteomyelitis are most likely to have a history of a cat bite on the hand. There have been at least 12 such reported cases and, despite aggressive surgical drainage and antibiotic therapy, those patients have had a poor functional outcome [8,10]. We treated our patient with a prolonged course of penicillin. He developed a rash about 3½ weeks into therapy. Tetracycline was substituted for a few days, but he stopped it as an outpatient because it upset his stomach. He has done well, in terms of controlling his infection. Although a follow-up gallium scan suggests that the inflammation has resolved, he is left with a significant functional defect in that hand. Unfortunately, that outcome is typical and underscores the need to diagnose and treat these infections as early as possible. As in all trauma-related injuries, adequate drainage is as important as antibiotic therapy [10,15].

DR. WALTER HIERHOLZER *(Professor of Medicine and Epidemiology):* While most cases of *P. multocida* infections involve domestic animals, farm animals are also colonized with this organism. Physicians in rural areas need to keep that in mind when treating routine injuries. For example, cows are not very intelligent. They will sometimes swallow great chunks of wire. The cure is to reach into the first of the cow's stomachs with one's arm in a long glove. If one gets scratched on the shoulder, one has an inoculum site on the upper arm.

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